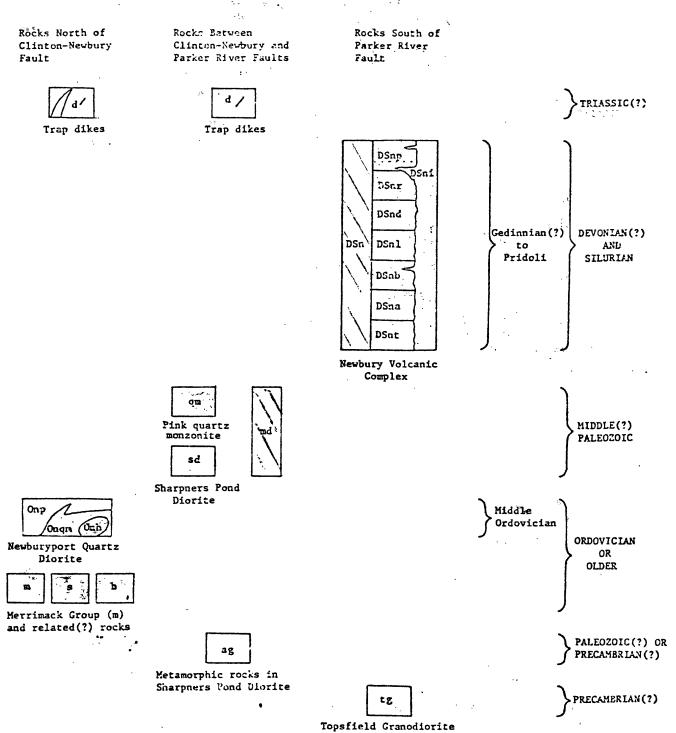
U. S. Geological Survey
OPEN FILE MAP 76-488
This map is preliminary and has
not been edited for conformity;
with Geological Survey standards
or nomenclature.

## CORRELATION OF MAP UNITS

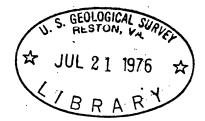


Formations of the individual columns are separated by faults of large displacements. Age data are scanty. The sequence of formations in a given column is firmly established but relative positions (as well as most of the ages) from column to column are speculative and subject to modification

EXPLANATION FOR PRELIMINARY GEOLOGIC MAPS OF NEWBURYPORT WEST AND EAST QUADRANGLES,

MASSACHUSETTS-NEW HAMPSHIRE

SHEET I



Fault--Dashed where approximately located; short dashed where interred

MAP STUROLS

Strike and dip of beds (and of flow-banding in laves) -- Rall indicates tops known from sedimentary atructures

60 Cverzuraad

Strike and dip of joints

70 Inclined

Vertical ...

Strike and dip of foliation-Where shown in sd and gm is on menoliths of ag too small to depict on map

Inclined. Vorilcal ...

> Strike and dip of primary foliation in plutonic rocks-Shown only in Newburyport Quartz Diorite; defined mainly by mafic inclusions; some symbols in Onp reflect aligned

phenocrysts

Inclined

Strike and dip of sheat zone

Verticel ممينر

Vertical .

Strike and dip of veins-Most fillings are quartz or calcite:

e few include aulfides

40 L- Inclined

. Yerrical

Prospect pits, and absordanced mines

Note: Tatersection of combined symbols is at point of observe

Bedrock exposures--Solid color indicates individual outcrous.

Ruled pattern indicates areas where aurficial deposits a: mostly less than 2 m thick individual outcross, commonly numerous, are not everywhere shown. Ourcrops shown in waterways are exposed at lowest tides

EXPLANATION FOR PRELIMINARY GEOLOGIC MAPS OF NEWBURYPORT WEST AND EAST QUADRANCE

HASSACHUSETTS-NEW, HAMPSHIRE

Marie The (new-burges t Cast quest). Med 127,000 1716, SHEET 3

76,-422m

very friable medium-light-gray to dark-gray phyllites, which range compositionally from those almost wholly of muscovite and quartz to those in which the dominant minerals -- other than quartz--are biotite and/or carbonate; sibite is a countituent of some. Pyrite is sparse to abundant. The nonfriable rocks waather pale brown to dark yellowish orange, and in all the phyllites rust-encrusted joint and .fracture surfaces are characteristic-

Metaeandstones in Seabrook--Gray, micaceous quartz-feldspar schists (metamorphosed feldspathic sandstone in which compositional layering is relict). Locally includes sillimanice. Sparsely pyritic but very rusty weathering

5

42

Amphibolite at mouth of Merrimack River--Massive dark-gray to olive-black very fine grained, pyritic amphibolite (metabasalt?). Foliation poorly developed. Rock is composed moetly of hornblende and derived chlorite and includes little plagioclase; some with 10 percent or more of plagioclase also contains inclusion=riddled oligoclase(?) laths suggestive of relict microphenocrysts. Distribution shown is wholly speculative

METAMORPHIC ROCKS ENCULFED IN SHARRNERS FOND DIORITE (PALLOZOIC? OR PRECAMBRIAN?) -- Massive-layered rocks ranging from finegrained amphibolites to coarse-grained feldspathic gneisses. In many places distinguished only with difficulty from the diorites pervasively intrueive into them. Locally includes calc-eilicate or fine-grained marble lenses and pyritic hornfels derived, respectively, from argillaceous or charty dolomites and anaerobic muds; thin quartite leases are aperae

tg | TOPSFIELD GRANODIORITE (PRECAMBRIAN?) -- Madium to coerse-grained granodiorite, composed of grayish-orange-pink feldspar, translucent light-gray quartz, grayish-yellow-green epidote end dark-greenish-gray to greenish-black aggregates of chlorite and epidote. In this aree the Topsfield rarely lacks foliation that is a consequence of widespresd . cataclasis. This foliation is defined by lenticular aggregates of quartz, which with the conspicuously orangish and more nearly equidimensional feldspar grains, appear in contrast to the wispy to irregularly splocchy greenish matrix, darkly tinted by the mafic minerals. The latters altered presumably from hormblende and biotice, ere sperse in this section, end are negescopically apparent out of proportion to their volume. In little-foliated rock leafy chlorite speckles freshly broken surfaces but may be inconepicuous on weathered auxfeces. In the foliated granodiorite pocassium feldspar is almost everywhere absent, apparently obliterated by cataclasis; though fractured, and commonly thoroughly sericitized the plagicalize shows the least obliteration of original grain outlines. In many localities a bluish cast typifies the quartz leases, which are notably coarsor than the plagioclase relicts; furthermore the quertz content is generally too high--locally in excess of 40 percent—to be representative of the original

ح کینا اگر

Cm3.1

plutonic rock

## DESCRIPTION OF MAP UNITS

TRAP DIKES (TRIASSIC?) -- Durk-gray to dark-greenish gray, finegrained mufic runks, mostly in dikes too small to be shown except by symbol. Principal variety is altered olivine diabase, subophitic to intergranular in texture. In a less abundant variety the primary mafic mineral is hornblende. Pyrite sparse to abundant KEYBURY VOLCAPIC COMPLEX (DEVONIAN? AND SILURIAN)

Micrographic rhyolice intrusions--Brownish-gray to orange pink, aphanitic to sugary-textured massive felsite, characterized by micrographic and spherulitic intergrowths; apherulites megascopically visible in some outcrops

Porphyritic addesite member -- Propylitized grayish-green to dark gray andesite, typified by plagioclase phenocrysts. Nonatratified volcaniclastic layers, ranging from finegrained tuffs to boulder breccias, are much more voluminous than intercalated flows: stratified graywacke is subordinate. Sparsely fossiliferous. Conglowerate containing rhyolite pubbles derived from DSnr shown by line of dots. 1,650 m thick

Flow-banded rhyblice vicrophyre member-Dense, lithoidal vitrophyre, mostly grayish red and conspicuously laminated: large parts not porphyritic; includes sparse lenses of vittic tuff; locally basal 120 m is pumiceous tuff. 580-670 m thick

Basalt(?) member--Dense, tough, dark gray, structureless rock. DSnd 0-90 m thick

> Vitric rhyolite lapilli tuff member--Grayish-green, friable. backly fracturing tuff, in which flattened pumice fragments

Basalt flow member--Uniformly fine-grained propylitized flows, devoid of fragmented materials; each 30 m or more thick, and separated by thin lithified soil(?) zones. 250-300 m thick

Fine-grained andesite(?) member -- Thoroughly propylitized, very fine grained, olive to olive-brown rock: part conspicuously to vaguely laminated, part massive and amygdaloidal(?). 275(?) m thick

Rhyolice tuff member-Flinty vellow-brown to brownish-gray vitroclastic rock, studded with darker fragments that are felted in texture. 6+ m thick

Newbury Complex undivided, where completely covered by unconsolidated materials

PINK QUARTZ MONZONITE (MIDDLE? PALEOZOIC) -- Pinkish-gray to gravish-orange-pink, rusty-Veathering, medium to coursegrained seriate-textured rock, characterized by grayishorange-pink translucent perthitic microcline of very irregular outline, clear gray quartz, and minute (\*1 mm) record flakes of bright biotics. Owartz and milky white oligoclase each compose about one-third of the rock, microcline somewhat less, and biotite about 5 percent. The characteristic inequigranular texture varies with size of the microcline grains; as these progressively increase in size the texture becomes, first, subtly porphyritic, then obviously perphyritic with phenocrysts as such as 20 mm in length. Phases most nearly equigranular are Comfount and are mostly quartz monzonite; the distinctly purphyritic phases are granudiorite. Contaminated phases, found especially in border zones where intrusion brecving with district wall rocks were formed, lack the pinklish

ring are medium- to fine-grained, and include both ornblende and biggite, both--in contrast to biotite of the normal rock-dulled by chloritization. Where ghosted outlines of menoliths are not apparent the more rufic parts of these contaminated zones, in places tena of matres in width, are difficult to distinguish from the lighter-colored coarser parts of the Sharpners Pond Diorite

SHARPNERS POND DIGRITE (MIDDLE? PALEOZOIC) -- Fine-erained. sd medium- to dark-gray, biotite-hornblende diurite; a thin grayish-orange-pink weathering rind churacterizes many outerops. Quartz content quite variable: quartz is rarely absent, commonly is 2-8 percent, and in some are very locally exceeds 15 percent. Where diorite occurs as intrusion breccies in combination with metamorphic host rocks, it may be lighter in color than usual and is screaked with feldspathic voins or appears foliated-owing either to flow-banding or to relict foliation of partially assimilated echists. These breccias may be difficulty distinguishable from the "nonfoliated"-as opposed to "streaked" -- light-colored breccies formed where the diorize was in turn inflated by pink quartz monzonite

Pink quartz monzonite and Sharpners Pond Diorite undivided, where completely covered by unconsolidated meterials

NEWBURYPORT QUARTE DIORITE (MIDDLE ORDOVICIAN) -- Formacion in characterized by saussuritized andesine as conspicuous, blocky crystals, thick books of chloritized biotite then are in part obviously euhedral, pink to green mottling on weathered surfaces, and ovoid inclusions that are mineralogically and texturally similar to the host but are fine-grained and contain 50 percent or more of the mafic minerals

Medium-grained, greenish-gray to light-olive-green equigranular rock that forms core and largest part of Newburyport pluton; ranges compositionally from quartz monzonite in aducharm outcrops to mafic granodiorite in northern exposures. Hornblende may occur in equal proportions to biotite in the more mafic phases. Reddish-brown sphene commonly apparent to unsided eve. Ubiquitous ovrice is cause of rust-stained outcrops

apn0

Oap Porphyritic granodiorite-Ta similar to the least ma(ic parts of the core rock, Onen, except that orthoclase is confined almost wholly to phenocrysts, which are as much as 6 by 9 cm in dimensions, and hornblende is entirely absent. Locally, two or more sets of thin aplice dikes abundantly rib the porphyritic granodiorite

Onh Greenish-black, medium-grained hornblendic acgregation, in which hornblends plus bietite compose 45 to 75 percent of the rock and orthoclase plus sericitized placioclase-cuite variable in their proportions-make up most of the remainder. Schene is uniquitous

EMPLANATION FOR PRELIMINARY GEOLOGIC MAPS OF NEWBURYPORT WEST AND EAST QUADRANGLES. MASSACHUSETTS-NOW HAMPSHIRE

SHUET 2 U. S. Geological Survey OPEN FILE MAP This map is preliminary and has not been edited for conformity with Geological Survey standards or nomenclature.

are abundant in shard-rich matrix. 0-52 m thick

DSa1

DSnb

Dání

DSap

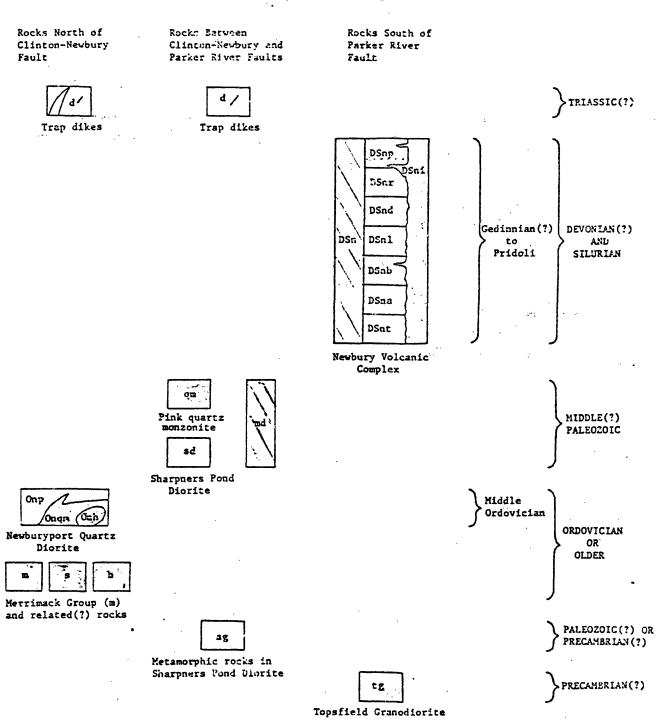
DSar

DSag i

DSat

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# CORRELATION OF MAP UNITS

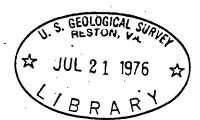


<sup>\*</sup>Formations of the individual columns are separated by faults of large displacements. Age data are scanty. The sequence of formations in a given column is firmly established but relative positions (as well as most of the ages) from column to column are speculative and subject to modification

EXPLANATION FOR PRELIMINARY GEOLOGIC MAPS OF MEWEURYPORT WEST AND EAST QUADRANGLES,

MASSACHUSETTS-NEW HAMPSHIRE

SHEET 1



and quartz to those in which the dominant minerals--other than quartz--are biotite and/or carbonate; sibite is a

constituent of some. Pyrite is aparse to abundant. The nonfriable rocks weather pale brown to dark yellowish orange, and in all the phyllites rust-encrusted joint and

fracture surfaces are characteristic

Metasandstones in Seabrook--Gray, micaceous quartz-feldapar echiats (metamorphosed feldspathic sandstone in which compositional layering in relict). Locally includes sillimanite. Sparsely pyritic but very rusty weathering

Amphibolite at mouth of Merrimack River--Massive dark-gray to olive-black very fine grained, pyritic amphibolite (metabasalt?).

Foliation poorly developed. Rock is composed mostly of hornblende and derived chlorite and includes little plagioclase; some with 10 percent or more of plagioclase also contains inclusion-riddled oligoclase(?) latha suggestive of relict microphenocrysts. Distribution shown is wholly speculative

METAMORPHIC ROCKS ENGULFED IN SHARPNERS POND DIORITE (PALLOZOIC?

OR PRECAMBRIAN?)—Massive-layered rocks ranging from finegrained amphibolites to coarse-grained feldspathic gneisses.

In many places distinguished only with difficulty from the
diorites pervasively intrusive into them. Locally includes
calc-silicate or fine-grained marble lenses and pyritic
bornfels derived, respectively, from argillaceous or
cherty dolomites and anserobic muds; thin quartrite lenses

TOPSFIELD CRANODIORITE (PRECAMBRIAN?) -- Medium- to coarse-grained granodiorite, composed of grayish-orange-pink feldspar, translucent light-gray quartz, grayish-yellow-green epidote and dark-greenish-gray to greenish-black aggregates of chlorice and epidote. In this area the Topsfield rarely lacks foliation that is a consequence of widespread  $\cdot \cdot \cdot$ cataclasis. This foliation is defined by lenticular aggregates of quartz, which with the conspicuously orangish and more nearly equidimensional feldspar grains, appear in contrast to the wispy to irregularly splotchy greeniah matrix, darkly tinted by the mafic minerals. The latter, eltered presumably from hornblende and biotice, are sparse in thin section, and are megascopically apparent out of proportion to their volume. In little-foliated rock leafy chlorite speckles freshly broken surfaces but may be inconspicuous on weathered surfaces. In the foliated granodiorite potassium feldspar is almost everywhere absent, epperently oblicerated by cataclasis; though fractured and cormonly thoroughly sericitized the plegioclase shows the least obliteration of original grain outlines. In many localities a bluish cast typifies the quartz leases, which are notably coarser than the plagioclase relicts; furthermore the quartz content is generally too high--locally in excess of 40 percent -- to be representative of the original plutonic rock

## MAP SYMBOLS

- Contact -- Dashed where approximately located; where dashed when inferred beneath extensive cover or poorly defined in zone of intrusion breccia.

Fault--Dashed where approximately located; short dashed where interred

Strike and dip of beds (and of flow-banding in levas)--Rall indicates tops known from sedimentary structures

ارخ Inclined

→ Vertical

60 Gverruraed

Strike and dip of joints

70 Inclined

yertical

Strike and dip of foliation—Where shown in sd and gm is on xenoliths of ag too small to depict on map

40 Inclined

Vertical

Strike and dip of primary foliation in plutonic rocks--Shown only in Newburyport Quartz Diorite; defined mainly by mafic inclusions; some symbols in Onp reflect aligned phenocrysts

تر Inclined سلا

₩ Vercical

Strike and dip of shear zone

Inclined سلم

Vertical مجلر

Strike and dip of veins-Most fillings are quartz or calcite; a few include sulfides

40 Inclined

\_ t Vertical

X Prospect pits and abandoned mines

Note: Intersection of combined symbols is at point of observa

Bedrock exposures-Solid color indicates individual outcrops.

Ruled pattern indicates areas where surficial deposits ar mostly less than 2 m thick-individual outcrops, commonly numerous, are not everywhere shown. Outcrops shown in waterways are exposed at lowest tides

EXPLANATION FOR PRELIMINARY GEOLOGIC MAPS OF NEWBURYPORT WEST AND EAST QUADRANCL

HASSACHUSETTS-NEW HAMPSHIRE

Marine (newlumpsont East qual). Ilea 1:21,000.12/4. SHEET 3

shout 5

76-482m

#### DESCRIPTION OF MAP UNITS

TRAP DIKES (TRIASSIC?) -- Durk-gray to dark-greenish gray, finegrained mafic rocks, mostly in dikea too small to be shown except by symbol. Principal variety is altered olivine diabase, subophitic to intergranular in texture. In a less abundant variety the primary mafic mineral is hornblende. Pyrite sparse to abundant

KEWBURY VOLCANIC COMPLEX (DEVONIAN? AND SILURIAN)

Dáni

DSnp

DSar

DSnd |

DSa1

DSnb

DSq.

DSnt

Micrographic rhyolite incrusions-Brownish-gray to orange-· pink, aphanitic to sugary-textured massive felsite, characterized by micrographic and spherulitic intergrowths; spherulites megascopically visible in some outcrops

Porphyritic andesite member -- Propylitized grayish-green to dark gray andesite, typified by plagioclase phenocrysts. Nonstratified volcaniclastic layers, ranging from finegrained tuffs to boulder breccias, are much more voluminous than intercalated flows; stratified graywacke is subordinate. Sparsely fossiliferous. Conglowerats containing rhyolite pebbles derived from DSnr shown by line of dots. 1.650 m

Flow-banded rhyblite vitrophyrs member-Dense, lithoidal vitrophyre, mostly grayish rad and conspicuously laminated; large parts not porphyritic; includes sparse lenses of vitric tuff; locally basal 120 m is pumiceous tuff. 580-670 m thick

Basalt(?) member-Dense, tough, dark gray, structureless rock. 0-90 m thick

Vitric rhyolite lapilli tuff member--Grayish-green, friable. backly fracturing tuff, in which flattened pumics fragments are abundant in shard-rich matrix. 0-52 m thick

Basalt flow member--- Uniformly fine-grained propylitized flows, devoid of fragmented materials; each 30 m or more thick, and separated by thin lithified soil(?) zones. 250-300 m thick

Fine-grained andesite(?) member-Thoroughly propylitized, very fine grained, olive to olive-brown rock: part conspicuously to vaguely laminated, part massive and amygdaloidal(?). 275(?) m thick

Rhyolice tuff member--Flinty yellow-brown to brownish-gray vitroclastic rock, studded with darker fragments that are felted in texture. 6+ m thick

Newbury Complex undivided, where completely covered by unconsolidated materials

PINK QUARTZ MONZONITE (MIDDLE? PALEOZOIC) -- Pinkish-gray to grayish-orange-pink, rusty-weathering, medium- to coarsegrained seriate-textured rock, characterized by grayishorange-pink translucent perthitic microcline of very irregular outline, clear gray quartz, and minute (<1 mm) ragged flakes of bright biotite. Quartz and milky white oligoclase each compose about one-third of the rock, microcline somewhat less, and biotite about 5 percent. The characteristic inequigranular texture varies with size of the microcline grains; as these progressively increase in size the texture becomes, first, subtly porphyritic, then obviously perphyritic with phenocrysts as much as 20 mm in length. Phases most hearly equigranular are dominant and are mostly quartz nonzonite; the distinctly porphyritic phases are grandiorite. Contaminated phases, found especially in border zones where intrusion breecise with diaritic wall rocks were formed, lack the pinklish

tint, are medium- to fine-grained, and include both hornblende and biotite, both -- in contrast to biotile of the normal rock-dulled by chloritization. There ghosted outlines of xenoliths are not apparent the more mafic parts of these contaminated zones, in places tens of metres in width, are difficult to distinguish from the lighter-colored, coarser parts of the Sharpners Pond Diorita

SHARPNERS POND DIORITE (MIDDLE? PALEOZOIC) -- Fine-grained, medium- to dark-gray, biotite-hornblende diorite; a thin grayish-orange-pink weathering rind characterizes many outcrops. Quartz content quite variable: quartz is rarely absent, commonly is 2-8 percent, and in some areas very locally exceeds 15 percent. Where diorite occurs as intrusion breccies in combination with metsmorphic host rocks, it may be lighter in color than usual and is streaked with feldspathic veins or appears foliated-owing either to flow-banding or to relict foliation of partially assimilated schists. These breccias may be difficulty distinguishable from the "nonfoliated"-as opposed to "streaked"-light-colored braccias formed where the diorite was in turn inflated by pink quartz monzonite

sd

md

Onh

Pink quartz monzonite and Sharpners Pond Diorits undivided, where completely covered by unconsolidated materials

NEWBURYPORT QUARTZ DIORITE (MIDDLE ORDOVICIAN)-Formation is characterized by saussuritized andesine as conspicuous. blocky crystals, thick books of chloritized biotite that are in part obviously enhancel, pink to green mottling on weathered surfaces, and ovoid inclusions that are mineralogically and texturally similar to the host but are fine-grained and contain 50 percent or more of the mafic minerals

Onqu Medium-grained, greenish-gray to light-olive-green equigranular rock that forms core and largest part of Newburyport pluton; ranges compositionally from quartz monzonite in southern outcrops to mafic granodiorite in northern exposures. Hormblende may occur in equal proportions to biotite in the more mafic phases. Reddish-brown sphane commonly apparent to unsided eye. Ubiquitous pyrite is cause of rust-stained outcrops

Porphyritic granodiorite-Is similar to the least mafic parts qeO of the core rock, Onqm, except that orthoclase is confined almost wholly to phenocrysts, which are as much as 6 by 9 cm in dimensions, and hornblende is entirely absent. Locally, two or more sets of thin aplite dikes abundantly rib the porphyritic granodiorite

> Greeniah-black, medium-grained hornblendic segregation, in which hornblende plus biotite compose 45 to 75 percent of the rock and orthoclase plus sericitized plagioclase-cuite variable in their proportions--make up most of the remainder. Sphene is ubiquitous

EXPLANATION FOR PRELIMINARY GEOLOGIC MAPS OF NEWBURYPORT WEST AND EAST QUADRANGLES. MASSACHUSETTS-NEW HAMISHIRE

SHEET 2

U. S. Geological Survey OPEN FILE MAP This map is preliminary and has not been edited for conformity with Geological Survey standards or nomenclature.